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Clinical Significance of Panoramic Radiography Before Edentulous Patients Rehabilitation with Removable Complete Denture: A Retrospective Study

Dişsiz Hastaların Tam Protez ile Tedavisi Öncesi Alınan Panoramik Radyografilerin Klinik Öneminin Değerlendirilmesi: Bir Retrospektif Çalışma

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ABSTRACT Objective: The aim of this study was to assess the necessity of digital panoramic radiographs before patients' rehabilitation with removable complete denture and the rate of significant radiographic findings. **Material and Methods:** A total of 162 digital panoramic radiographs of edentulous patients were recorded over two years. The inclusion criteria were being edentulous and over 18-year old. The exclusion criterion was the insufficient quality of radiographs. All radiographs were analyzed by an oral and maxillofacial radiologist and a prosthodontist. Radiographic findings were classified as a radiopaque lesion, radiolucent lesion, mixed lesion, and extragnathic lesion. Radiographic findings were recorded and evaluate for requiring a pre-treatment before removable complete denture fabrication. The data were analyzed using SPSS v22.0 software (IBM Corp.). The level of significance was set at α=0.05. Descriptive data were calculated. **Results:** Panoramic radiographs of 86 (53%) female and 76 (47%) male were evaluated. 177 radiographic findings were identified at 107 (66%) panoramic radiographs. Radiopaque findings (46.5%) are the most frequent ones, among which root(s) or root fragment(s) (27%) are the most common. The percentage of radiographic findings which influence the treatment was 8.5%. **Conclusion:** Requesting routine panoramic radiography may not be provide great benefit to the patient. However, a detail anamnesis and examination should provide to decide the necessary of the panoramic radiography.

Keywords: Mouth, edentulous; diagnostic imaging; denture, complete; radiography, panoramic

ÖZET Amaç: Bu çalışmanın amacı, hastaların hareketli tam protez ile rehabilitasyonundan önce dijital panoramik radyografilerin gerekliliğini ve önemli radyografik bulguların oranını değerlendirmektir. **Gereç ve Yöntemler:** Toplam 162 dişsiz hastanın iki yıl boyunca panoramik radyografi kayıtları değerlendirildi. Dahil edilme kriterleri 18 yaş üstü ve tam dişsiz olmaktı. Tüm radyografiler bir ağız, diş ve çene radyoloji uzmanı ve bir protetik diş tedavisi uzmanı tarafından incelendi. Radyografik bulgular radyoopak lezyon, radyolusent lezyon, karışık lezyon ve ekstragnatik lezyon olarak sınıflandırıldı. Dışlama kriteri radyografilerin yetersiz kalitede olmasıydı. Tüm radyografik bulgular kayıt edildi ve tam protez yapımından önce gerekebilecek ön tedaviler açısından değerlendirildi. Veriler SPSS v22.0 yazılımı (IBM Corp.) kullanılarak analiz edildi. Anlamlılık düzeyi α =0,05 olarak belirlendi. Betimsel veriler hesaplandı. **Bulgular:** Çalışmada panoramik radyografileri değerlendirilen hastaların 86'sı (%53) kadın, 76'sı ise (%47) erkekti. Yüz yedi (%66) panoramik radyografide toplam 177 bulgu saptandı. Bunların çoğunluğu radyoopak bulgular (%46,5) idi. Radyoopak bulguların çoğunluğunu da kök ve kök parçaları (%27) oluşturmaktaydı. Tedavi gerektiren bulgu yüzdesi ise %8,5 idi. **Sonuç:** Tam dişsiz hastalarda rutin panoramik radyografi istemek hastaya büyük bir fayda sağlamayabilir. Panoramik radyografinin gerekli olduğuna karar vermek için ayrıntılı bir anamnez ve inceleme yapılmalıdır.

Anahtar Kelimeler: Ağız, dişsiz; tanısal görüntüleme; protez, tam; radyografi, panoramik

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Different treatment options are available for edentulous patients, however, the first treatment option that comes to mind is removable complete dentures (RCD). Before the treatment plan, a detailed intraoral examination is conducted by the clinician and the radiographic examination of edentulous jaws provides to detect pathological conditions that may not have seen intraorally.

Panoramic radiograph provides to record rapid single film and examine the edentulous maxilla and mandible.[1] The clinician can diagnose the quantity of residual alveolar ridge, root fragments, unerupted teeth, fractures, radiolucencies, radiopacities, foreign bodies, and anatomic structures and variations.[1,2]

"The Selection of Patients for X-Ray Examination developed in 1987 by a panel of dental experts convened by the Center for Devices and Radiological Health of the U.S. Food and Drug Administration (FDA) and endorsed by the American Dental Association recommends a full mouth intraoral or panoramic radiographic examination for newly edentulous patients."[3,4] For the use of dental radiographs (Update and recommendations), American Dental Association Council on Scientific Affairs suggested individualized radiographic examination, based on clinical signs and symptoms.[5] According to the European Guidelines on Radiation Protection in Dental Radiology, panoramic radiographs should not be taken in the absence of any clinical signs or symptoms.[6] International Commission on Radiological Protection 1991 suggested that one justifies the reason for exposure to x-rays and 2007 version emphasis oral region particularly salivary glands because of increased cancer incidence due to the dental radiography.[7-9]

Authors argued the benefit of panoramic radiographs before the prosthodontic treatment. Some stated that not many pathological findings affected the treatment of edentulous patients who required RCD however, some reported panoramic radiographs should be examined regardless of symptoms.[10,11]

Previous studies have reviewed the frequency of the symptomatic and asymptomatic findings.[1,2,12-14] However, limited studies focused on the significance of digital panoramic radiographs before receiving RCD.[10,11,15,16] Inconsistent results have been reported regarding the value of digital panoramic radiographs and the rate of radiographic findings requiring treatment. Therefore, this study aimed to assess the necessity of digital panoramic radiographs before patients' rehabilitation with RCD and the rate of significant radiographic findings.

The null hypothesis was that before patients' rehabilitation with RCD, taken digital panoramic radiographs would not have a significant effect on clinical conditions.

MATERIAL AND METHODS

This retrospective study was approved by the Non-interventional Medicine Ethics Committee of Uşak University Faculty of Medicine with decision number (date: 17.01.2019, no: 146-09-12). This study conforms to the Declaration of Helsinki. Patients who requested maxillary and mandibular RCD at Uşak University Faculty of Dentistry from June 2016 to December 2018 were included.

Each eligible patient information recorded (gender and age) and had a digital panoramic radiograph as a routine part of the examination and 162 digital radiographs were taken by a certified dental assistant. The same digital panoramic X-ray machine (Vatech Digital X-ray Imaging System PCH-2500; Seogu-dong, Kore) was used.

Thirty radiographs were selected and examined on the same computer (MacBook Pro, USA) under ambient lighting by two examiners. Cohen's kappa test was used to determine the agreement between the examiners. Panoramic radiographs were reviewed by the oral and maxillofacial radiologist and the prosthodontist.

The inclusion criteria were being edentulous and over 18-year old. The exclusion criterion was the insufficient quality of radiographs.

Radiographic findings were classified as a radiopaque lesion, radiolucent lesion, mixed lesion, and extragnathic lesion according to a study by Kratz et al.[10] Anatomy of mental foramina and maxillary sinus recorded as non-pathological anatomic form. Treatment need was recorded after the radiographic evaluation.

The data were analyzed using SPSS v22.0 software (IBM, Armonk, NY). The level of significance was set at α=0.05. Descriptive data were calculated.

RESULTS

There were 86 female (53%) and 76 male (47%) patients. The mean age was 57 and ranged between 18 to 89. One-hundred seventy-seven radiographic findings were identified after analyzing 107 (66%) panoramic radiographs.

A total of 162 panoramic radiographies were analyzed in this study (Table 1). Before the fabrication of RCD, fifteen radiographic findings (8.5%) (eight retained root(s) or root fragment(s), five impacted teeth, one fibro-osseous lesion, and one nasopalatine cyst) required treatment (Figure 1A-D). Overall, radiopaque findings (46.5%) are the most frequent ones, among which root(s) or root fragment(s) (27%) are the most common (Table 2).

DISCUSSION

The aim of analyzing the panoramic radiographs before the prosthetic treatment as part of treatment planning is to identify the radiographic findings. Because high frequency rate prevalence of radiographic findings can be identified in the edentulous patients. According to the previous studies, the rate of edentulous patients with radiographic findings is about 16%-68.[1,3,13,14] Tronje et al. reported that about 30% of the patients had morphological and pathological changes.[13] Kratz et al. stated that at least one or more radiographic findings were identified in 60% of the radiographs.[10] These findings may be significant with their oral and general health conditions.[12] In the present study, the rate of radiographic findings was 66% and consistent

TABLE 1: Number of panoramic radiographs which have radiographic findings.

Radiographic finding	Number of panoramic radiographs with radiographic findings	Total radiographic findings
Radiopacity	63	82
Radiolucency	7	7
Mixed lesions	1	1
Extragnathic	50	75
TMJ	10	12
Total	131	177

TMJ: Temporomandibular joint.

FIGURE 1A: Root fragment in the left mandible.

FIGURE 1B: Impacted tooth in the right maxilla.

FIGURE 1C: Fibro-osseos lesion in the right mandible.

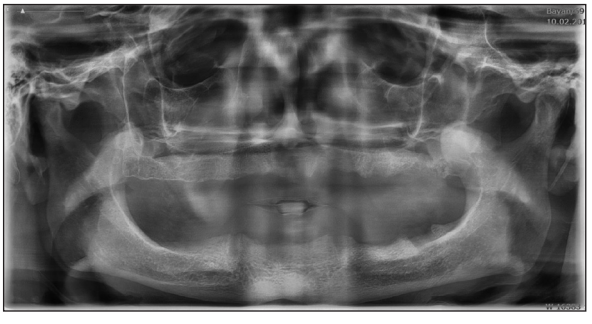

FIGURE 1D: Nasopalatine canal cyst in the middle of the maxilla.

TABLE 2: Radiographic findings (n=177).

Group of radiographic findings	Name and number of the radiographic findings
82 Radiopaque findings (46.5%)	47 retained root(s) or root fragment(s), 1 retention pseudocyst, 1 maxillary sinus antrolith, 6 socket sclerosis, 1 fibro-osseous lesion, 10 idiopathic osteosclerosis, 5 osteosclerosis (sclerosing oseitis), 2 enostosis, 1 fixation screw (metal fixation), 8 impacted teeth
7 Radiolucent findings (4%)	2 surgical defects, 1 wide nasopalatine canal, 3 cysts, 1 nasopalatine cyst
1 Mixed lesions (0.5%)	1 opasification
75 Extragnathic (42%)	10 stylohyoid ligament ossifications, 33 tonsilloliths, 1 osteophyte, 3 zygomatic process pneumatization, 15 laryngeal cartilage calcifications, 5 calcified lymph nodes,1 ear implant, 7 calcified carotid artery atheromas
12 TMJ findings (7%)	7 (4 left and 3 right) osteophyte, 2 (1 right and 1 left) mandibular subchondral cyst, 3 (2 right and 1 left) joint mice

TMJ: Temporomandibular joint.

with previous studies. Fortunately, serious infection and tumors were not detected in this study.

In the present study, 33 tonsilloliths were observed. Aoun et al. reported that tonsilloliths might be the reason for non-specific chronic halitosis and panoramic radiographs were useful observing of the palatine tonsilloliths.[17] There was one cervical osteophyte, which might cause dysphagia rarely. However, cervical osteophyte can reduce the quality of life by disrupting normal food intake.[18] Pneumatization of the zygomatic process of the temporal bone often does not require treatment and it may be associated with temporomandibular joint (TMJ) dysfunction.[19] In the present study, three zygomatic process pneumatizations were identified.

Calcified carotid artery atheroma (CCAA) are often intensely calcified and can be identified in routine panoramic radiographs.[20] Early diagnose of CCAA may reduce the risk of strokes. However, dentists do not routinely check for the presence of CCAA. According to a meta-analysis, dentists have an additional responsibility to examine CCAA which have vital consequences and panoramic radiographs are not the first-choice while diagnosing the CCAA, but it can be used as a screening method.[21] Seven CCAAs were detected in the present study.

Fibro-osseous lesions are often diagnosed radiographically, without performing histologic examinations. Fibro-osseous lesion pathophysiology varies widely from simple dysplasia to reactive lesions to formal neoplasms. Management of these conditions can range from monitoring to jaw resection. A detailed diagnosis is vital, some conditions need follow-up while others need surgical resection.[22] One fibro-osseous lesion was identified in the present study and it was followed.

Embryogenic remnants of nasopalatine duct cause nasopalatine duct cyst. It can be detected on routine radiographs or patient's symptoms. Histological analysis should be performed to accurate diagnose. Enucleation of the cystic tissue is often the first treatment.[23] A nasopalatine duct cyst was detected and needed a surgical treatment.

Kratz et al. summarized the percentage of radiographic findings that influence the treatment.[10] The percentage was between 0% and 8.3% except for a study by Keur et al.[24] They found 34% and decided that all root tips/fragments and unerupted teeth need surgical treatment. The mean of the percentage was 2.6% including the study by Kratz et al.[10] In the present study, the percentage of radiographic findings that influence the treatment was 8.5%. Therefore, the null hypothesis was that the taken digital panoramic radiographs before patients' rehabilitation with RCD would not have a significant effect on clinical conditions was accepted.

Retained root(s) or root fragment(s) were the most frequent radiopaque radiographic findings of the present study which was similar to previous studies.[10,25] In the present study, 47 (27%) retained root(s) or root fragment(s) were observed. They were particularly located in the posterior region. Similarly, in a study by Kose et al., the root fragments often located in the premolar-molar region.[11] According to Kose et al., the reasons for the posterior location of the root fragments were the difficulty of the opera-

tion in the posterior region, morphology, and number of roots.[11] Eight retained root(s) or root fragment(s) needed a surgical treatment before patients' rehabilitation with RCD because of radiolucent lesions.

Impacted teeth may cause dentigerous cysts, pain, and infections. Sumer et al. reported 3.1% of teeth impaction and Kose et al. reported 3.6%.[11,26] In the present study, eight impacted teeth were representing a frequency of 4.5%. However, five impacted teeth need surgical treatment before patients' rehabilitation with RCD because of bone resorption.

Opacification was the only mixed lesion of the radiographic findings which indicated a previous inflammation of the maxillary sinus.[27]

Winocur et al. studied the contribution of panoramic radiography diagnosis of degenerative joint diseases of TMJ.[28] They did not suggest panoramic radiography for the diagnosis of patients with temporomandibular dysfunction (TMD) similarly to current aspects. In the present study, panoramic radiography was not used for the diagnosis of TMD however radiographic findings of TMJ were recorded. Mandibular subchondral cyst, joint mice, and osteophytes were observed which might be associated with TMJ osteoarthritis.

The limitation of this study was that the clinical examination was not performed. Moreover, cone-beam computed tomography evaluation might be required for further and specific conditions. A prospective study with a clinical examination should be considered in future studies.

CONCLUSION

1. At least one radiographic finding was detected in 107 (66%) of 162 radiographs.

2. The percentage of radiographic findings that influence the treatment was 8.5%.

3. Requesting routine panoramic radiography may not provide great benefit to the patient. However, a detailed anamnesis and examination should provide to decide the necessity of the panoramic radiography.

4. All radiation exposures must be considered as low as reasonably achievable and unnecessary irradiation should be avoided.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Bengisu Yıldırım;* ***Design:*** *Bengisu Yıldırım, Halil Tolga Yüksel;* ***Control/Supervision:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken;* ***Data Collection and/or Processing:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken;* ***Analysis and/or Interpretation:*** *Bengisu Yıldırım, Halil Tolga Yüksel;* ***Literature Review:*** *Bengisu Yıldırım, Duygu Recen;* ***Writing the Article:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken;* ***Critical Review:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken;* ***References and Fundings:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken;* ***Materials:*** *Duygu Recen, Bengisu Yıldırım, Halil Tolga Yüksel, Gamze Paken.*

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